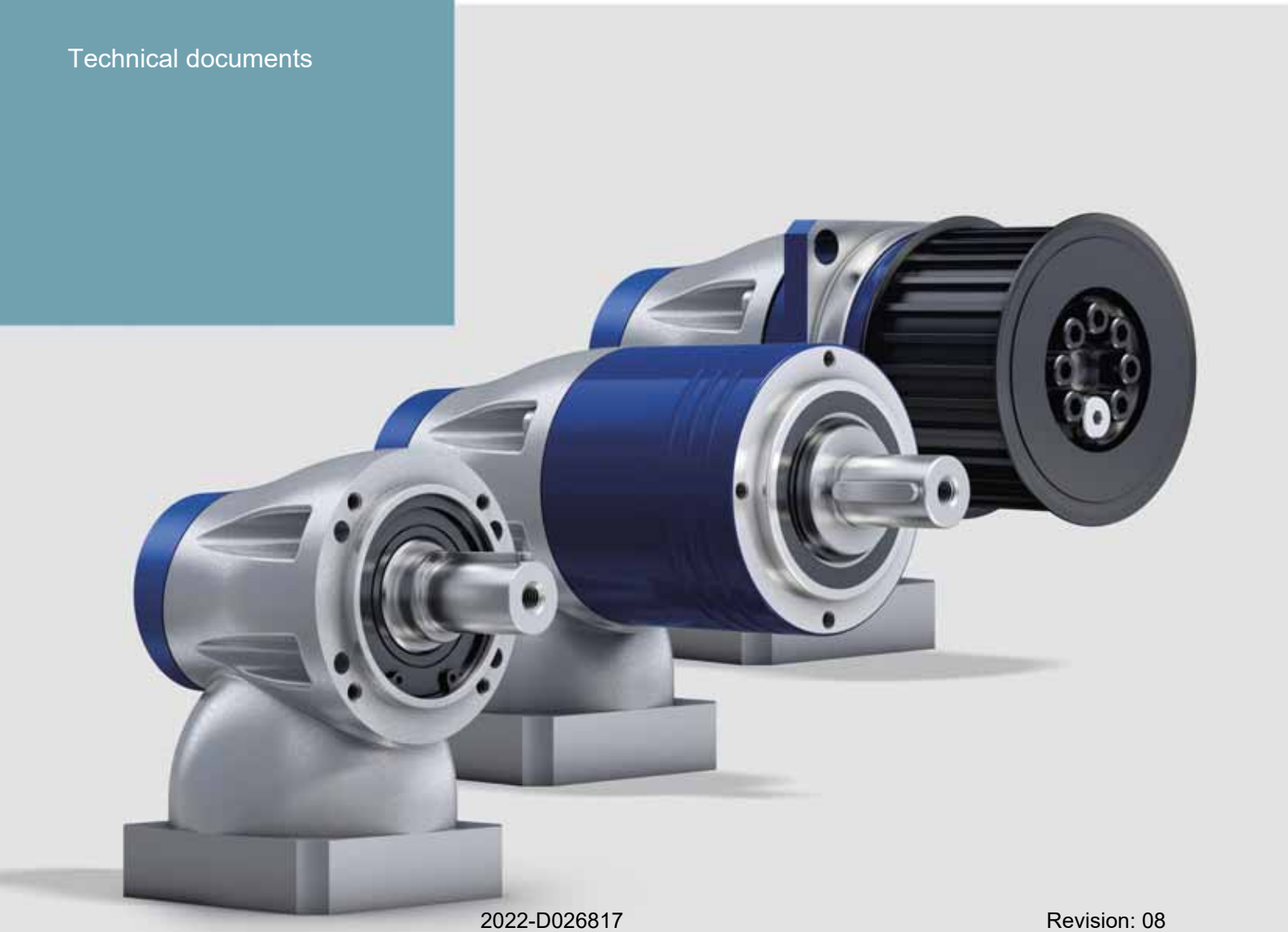
WITTENSTEIN | alpha

LK+/LPK+/LPBK+

Technical documents



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Revision: 08

Revision history

Revision	Date	Comment	Chapter
01	24.05.07	New version	All
01a	11.02.09	WITTENSTEIN Layout	All
02	01.08.09	Machinery Directive	1, 2, 3, 4, 6
03	09.03.10	LPBK+	All
03a	26.07.10	Technical Data	5.4.1
04	01.09.10	Technical Data	5.4, 9.1
05	11.03.15	LPBK+ 3 stage, safety; clamping hub	2.1, 2.5, 3.5, 5.3, 9.1
06	13.02.17	Mounting the motor	5.3
07	31.05.19	Adapter plate	5.1
08	25.10.23	Technical documents	Cover sheet

Service

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Contents

1 About this manual

These instructions contain necessary information for the safe operation of the right-angle gearhead LK+/LPK+/LPBK+, referred to as gearhead in the following.

If this manual is supplied with an amendment (e.g. for special applications), then the information in the amendment is valid. Contradictory specifications in this manual thereby become obsolete.

The operator must ensure that these instructions are read through by all persons assigned to install, operate, or maintain the gearhead, and that they fully comprehend them.

Store these instructions within reach of the gearhead.

These **safety instructions** should be shared with colleagues working in the vicinity of the device to ensure individual safety.

The original instructions were prepared in German; all other language versions are translations of these instructions.

1.1 Signal words

The following signal words are used to bring your attention to dangers, prohibitions, and important information:

	⚠ DANGER **This signal word points to an imminent danger that can cause serious injuries and even death.**
	⚠ WARNING **This signal word points to a possible danger that can cause serious injuries and even death.**
	⚠ CAUTION **This signal word points to a possible danger that can cause slight to serious injuries.**
	NOTICE **This signal word points to a possible danger that can cause material damage.**
	A note without signal word draws your attention to application tips or especially important information when handling the gearhead.

1.2 Safety symbols

The following safety symbols are used to bring your attention to dangers, prohibitions, and important information:


General danger


Hot surface


Suspended loads

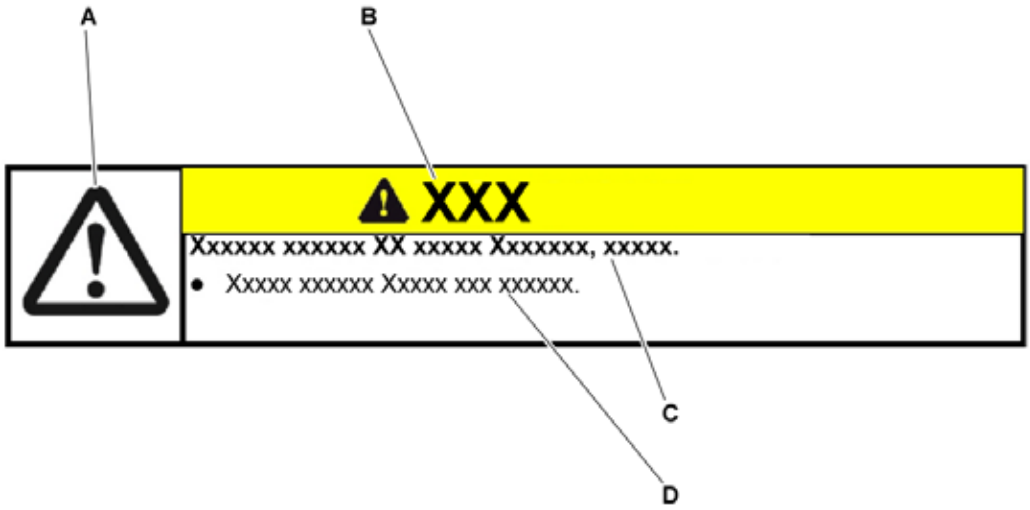

Danger of being pulled in


Environment protection


Information

1.3 Design of the safety instructions

The safety instructions of these instructions are designed according to the following pattern:



A = Safety symbol (see Chapter 1.2 "Safety symbols")

B = Signal word (see Chapter 1.1 "Signal words")

C = Type and consequence of the danger

D = Prevention of the danger

1.4 Information symbols

The following information symbols are used:

- Indicates an action to be performed

  ➲ Indicates the results of an action

ⓘ Provides additional information on handling

2 Safety

These instructions, especially the safety instructions and the rules and regulations valid for the operating site, must be observed by all persons working with the gearhead.

In addition to the safety instructions in this manual, also observe any (legal and otherwise) applicable environmental and accident prevention rules and regulations (e.g. personal safety equipment).

2.1 EC directives

2.1.1 Machinery directive

The gearhead is considered a "machine component" and is therefore not subject to the EC Machinery Directive 2006/42/EC.

Operation is prohibited within the area of validity of the EC directive until it has been determined that the machine in which this gearhead is installed corresponds to the regulations within this directive.

2.1.2 RoHS

The homogeneous materials used in the gearhead fall below the amounts of hazardous materials limited by directive 2011/65/EU Annex II.

- Lead (0.1%)
- Mercury (0.1%)
- Cadmium (0.01%)
- Hexavalent chromium (0.1%)
- Polybrominated biphenyls (PBB) (0.1%)
- Polybrominated diphenyl ether (PBDE) (0.1%)

Installation of the gearhead therefore has no effect on the restriction of using certain hazardous materials in electrical and electronic equipment as required in the directive.

2.2 Dangers

The gearhead has been constructed according to current technological standards and accepted safety regulations.

To avoid danger to the operator or damage to the machine, the gearhead may be put to use only for its intended usage (see chapter 2.4 "Intended use") and in a technically flawless and safe state.

- Read the general safety instructions before beginning work (see Chapter 2.7 "General safety instructions").

2.3 Personnel

Only persons who have read and understood these instructions may carry out work on the gearhead.

2.4 Intended use

The gearhead serves to convert torques and speeds. It is suitable for all industrial applications.

The gearhead may not be operated in areas with explosion hazards. In food processing, the gearhead may be used only next to or under the foodstuff area.

The gearhead is intended for installation on motors that:

- Correspond to the design B5 (in the event of deviations, consult our Customer Service department [technical Customer Service department]).
- Have a radial and axial runout tolerance according to DIN EN 50347.
- Have a cylindrical shaft end with tolerance class h6 to k6.

2.5 Reasonably foreseeable misuse

Any usage that exceeds the maximum permitted speeds, torques and temperature is considered a misuse and is therefore prohibited.

Co-riding the gearhead on the drive axle is prohibited. Exceptions require a written approval and technical statement from **WITTENSTEIN alpha GmbH**.

2.6 Guarantee and liability

Guarantee and liability claims are excluded for personal injury and material damage in case of

- Ignoring the information on transport and storage
- Improper use (misuse)
- Improper or neglected maintenance and repair
- Improper assembly / disassembly or improper operation (e.g. test run without secure attachment)
- Operation of the gearhead when safety devices and equipment are defective
- Operation of the gearhead without lubricant
- Operation of a heavily soiled gearhead
- Modifications or reconstructions that have been carried out without the approval of **WITTENSTEIN alpha GmbH**

2.7 General safety instructions

⚠ WARNING

Objects flung out by rotating components can cause serious injuries.

- Remove objects and tools from the gearhead before putting it into operation.
- Remove/Secure the shaft key (if available) if the gearhead is operated without attachments on the output/drive side.

⚠ WARNING

Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.

- Keep a sufficient distance to rotating machinery while the gearhead is running.
- Secure the machine against restarting and unintentional movements during assembly and maintenance work (e.g. uncontrolled lowering of lifting axes).

⚠ WARNING

A damaged gearhead can cause accidents and injury.

- Never use a gearhead that has been overloaded to due misuse or a machine crash (see chapter 2.5 "Reasonably foreseeable misuse").
- Replace the affected gearhead, even if no external damage is visible.

⚠ CAUTION

Hot gearhead housing can cause serious burns.

- Touch the gearhead housing only when wearing protective gloves or after the gearhead has been at standstill for some time.

NOTICE

Loose or overloaded screw connections can damage the gearhead.

- Use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.

⚠ WARNING

Lubricants are flammable.

- Do not spray with water to extinguish.
- Suitable extinguishing agents are powder, foam, water mist, and carbon dioxide.
- Observe the safety instructions of the lubricant manufacturer (see Chapter 7.4 "Notes on the lubricant used").

⚠ CAUTION

Solvents and lubricants can cause skin irritations.

- Avoid direct skin contact.

Solvents and lubricants can pollute soil and water.

- Use and dispose of cleaning solvents and lubricants properly.

3 Description of the gearhead

The gearhead is a single- or multi-stage angle gear, that is manufactured as standard in the "M" version (motor installation). The output shaft bearing is designed to withstand high tilting moments and axial forces.

For applications with special safety requirements (e.g. vertical axes, distorted gear inputs) we recommend employing exclusively our products alpheno®, RP+, SP+, TP+, TP+ HIGH TORQUE or consulting with **WITTENSTEIN alpha GmbH** .

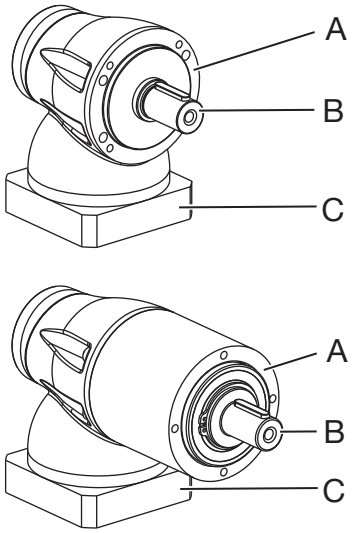
The motor centering is realized via the held receptacle for tabs, and not via the adapter plate. Radial clamping of the motor is avoided.

An adaptation to various motors is realized via an adapter plate and a bushing.

The optional LPBK+ has an output flange instead of an output shaft. This provides the option of mounting a toothed belt pulley.

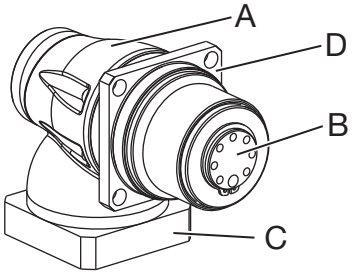
3.1 Overview of the gearhead components

3.1.1 Overview of the gearhead components LK+/LPK+

		Gearhead components LK+/LPK+
	A	Gearhead housing
	B	Output shaft
	C	Adapter plate

Tbl-1: Overview of the gearhead components

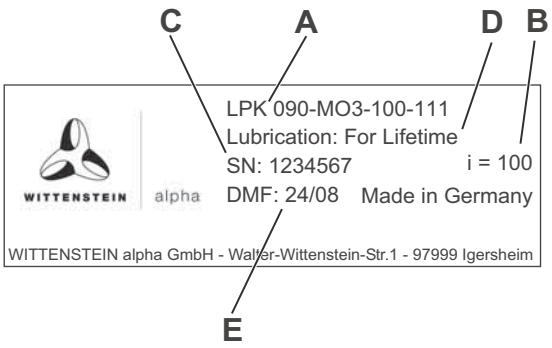
3.1.2 Overview of the gearhead components LPBK+

		Gearhead components LPBK+
	A	Gearhead housing
	B	Output flange
	C	Adapter plate
	D	Mountable flange

Tbl-2: Overview of the gearhead components

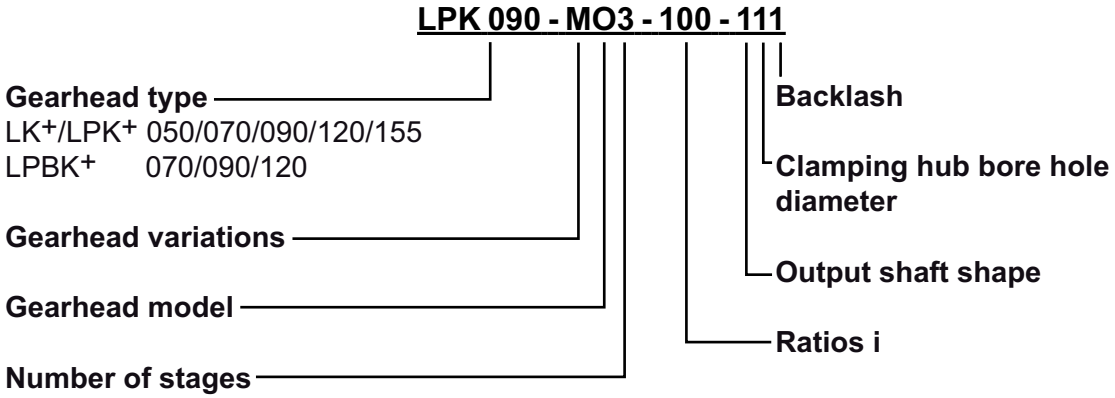
3.2 Identification plate

The identification plate is attached to the gearhead housing.

		Designation
	A	Ordering code (see Chapter 3.3 "Ordering code")
	B	Ratio
	C	Serial number
	D	Lubricant information
	E	Production date

Tbl-3: Identification plate (sample values)

3.3 Ordering code



3.4 Performance data

For the maximum permitted speeds and torques, refer to

- our catalog,
- our website www.wittenstein-alpha.de,
- the respective customer-specific performance data (X093–D...).

Consult our Customer Service department if the gearhead is older than a year. You will then receive the valid performance data.

3.5 Weight

The table "Tbl-4" specifies the gearhead weights with a medium-sized adapter plate. If a different adapter plate is mounted, the actual weight can deviate by up to 10 %.

Gearhead size LK+	**050**	**070**	**090**	**120**	**155**
1–stage [kg]	0.7	1.9	3.2	8.9	19
Gearhead size LPK+	**050**	**070**	**090**	**120**	**155**
2–stage [kg]	1.4	3.8	6.9	17	35
3–stage [kg]	1.6	4.2	7.9	19	39
Gearhead size LPBK+	**—**	**070**	**090**	**120**	**—**
2–stage [kg]	—	3.4	6.2	16	—
3–stage [kg]	—	3.8	6.9	17	—

Tbl-4: Weight

3.6 Noise emission

Depending on the gearhead type and product size, the continuous sound pressure level is up to 78 dB(A).

ⓘ For specifications on your particular product, refer to our catalogue or our Internet page at http://www.wittenstein-alpha.de or contact our Customer Service department.

- Observe the total noise pressure level of the machine.

4 Transport and storage

4.1 Scope of delivery

- Check the completeness of the delivery against the delivery note.

ⓘ Immediately notify the carrier, the insurance company, or **WITTENSTEIN alpha GmbH** in writing of any missing parts or damage.

4.2 Packaging

The gearhead is delivered packed in foil and cardboard boxes.

- Dispose of the packaging materials at recycling sites intended for that. Observe the locally valid regulations for disposals.

4.3 Transport

NOTICE

Hard knocks, because of falling or hard dropping, can damage the gearhead.

- Use only hoisting equipment and transportation devices with sufficient capacity.
- The permitted lifting weight of a hoist may not be exceeded.
- Lower the gearhead slowly.

⚠ WARNING

Suspended loads may fall and cause serious injuries and even death.

- Do not stand under suspended loads.

⚠ WARNING

The plastic lid on the gearhead may come off.

- Never transport the gearhead by the plastic lid.

No special transport mode is prescribed to transport the gearhead.

For specifications on the weights see Chapter 3.5 "Weight".

4.4 Storage

Store the gearhead in horizontal position and dry surroundings at a temperature of 0 °C to +40 °C in the original packaging. Store the gearhead for a maximum of 2 years. Consult our Customer Service department if the conditions are different.

For storage logistics, we recommend the "first in –first out" method.

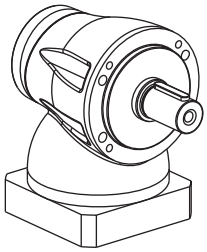
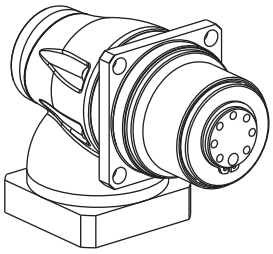
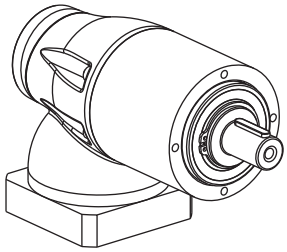
5 Assembly

- Read the general safety instructions before beginning work (see Chapter 2.7 "General safety instructions").

5.1 Preparations

The different assembly sequences for LK+/LPK+, and LPBK+ are listed in the table "Tbl-5".

ⓘ Our Customer Service department is available to answer any questions.

LK+/LPK+		LPBK+	
	—	**1** 5.2 "Mounting the gearhead to a machine (LPBK+ only)"	
	**1** 5.3 "Mounting the motor on the gearhead"	**2** 5.3 "Mounting the motor on the gearhead"	
	2 5.4 "Components mounted on the output side"	**3** 5.4 "Components mounted on the output side"	
	3 5.5 "Mounting the gearhead to a machine (LK+/LPK+ only)"	—	

Tbl-5: Assembly sequence

NOTICE

Pressurized air can damage the gearbox seals.

- Do not use pressurized air to clean the gearbox.

Directly sprayed cleaning agents can alter the frictional values of the clamping hub.

- Only spray cleaning agents onto a cloth for wiping off the clamping hub.

Operation without an adapter plate might lead to damage.

- Only install your own adapter plate or replace an adapter plate according to the specifications of **WITTENSTEIN alpha GmbH**. Our Customer Service department will provide you with disassembly instructions for this purpose.
- Operation without an adapter plate is prohibited.

In rare cases, a grease lubricated gearbox may show a small leak at the input (sweating).

To prevent seeping, we recommend to seal the surfaces between

- adapter plate and drive housing (gearbox), as well as between
- adapter plate and motor,

using a surface sealing adhesive (e.g. Loctite® 573 or 574).

- Check that the motor meets the specifications in Chapter 2.4 "Intended use".

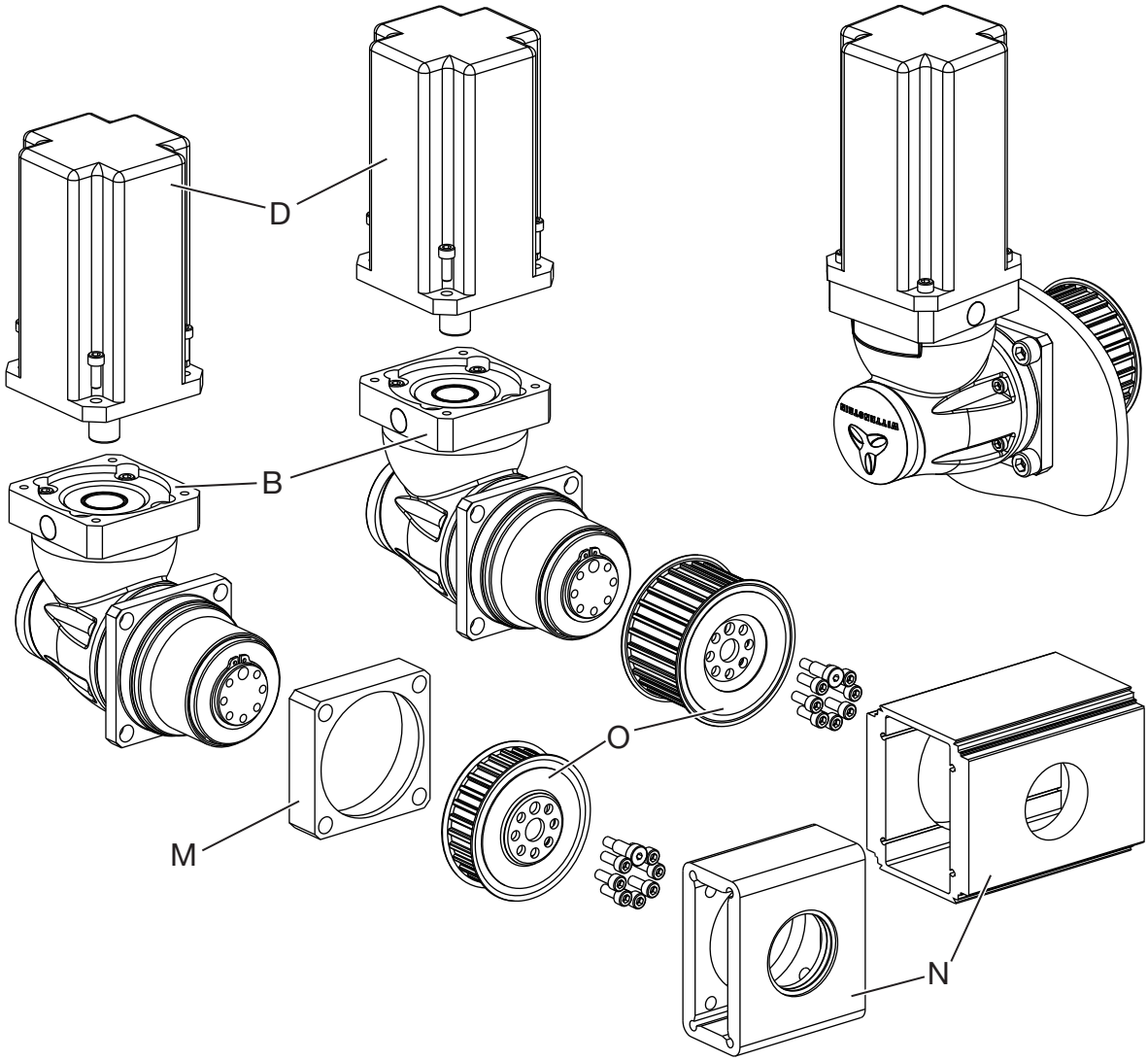
- Clean / Degrease the following components with a clean and lint-free cloth and grease-dissolving, non-aggressive detergent:
  - All fitting surfaces to neighboring components
  - Centering
  - The motor shaft
  - The inside diameter of the clamping hub
  - The bushing inside and out
- Dry all fitting surfaces to neighboring components in order to achieve the proper friction values of the screw connections.
- Check the fitting surfaces additionally for damage and impurities.
- Select screws for fastening the motor to the adapter plate according to the motor manufacturer's specifications. Observe the minimum screw depth as determined by the property class (see Table "Tbl-6").

Property class of the screws for fastening the motor	**8.8**	**10.9**
Minimum screw depth	1.5 x d	1.8 x d
d = Screw diameter		

Tbl-6: Minimum screw depth of the screws for fastening the motor to the adapter plate

5.2 Mounting the gearhead to a machine (LPBK+ only)

	● Observe the safety and processing instructions of the cleaning agents and threadlocker to be used.



ⓘ If necessary, a spacer (M) should be placed between gearhead and machine to fine-tune the gearhead position. Such a spacer is **not** part of the drive's scope of delivery and needs to be provided by the customer.

- Thoroughly clean the output flange, centering, fitting surface, spacer and toothed belt pulley. The anti-corrosion agent on the toothed belt pulley must be removed.

ⓘ To remove the anti-corrosion agent, use acetone or Loctite® 7063, and a clean, lint-free cloth.

- Also clean the browned toothed belt pulley with a brush and remove any salt residue between the flanged wheel and toothed belt wheel.

The fastening screws need to be provided by the customer.

ⓘ For appropriate screw sizes and tightening torques, see Chapter 9.2 "Specifications for mounting on a machine", Table "Tbl-17".

ⓘ When using hollow sections (N): Position the toothed belt pulley (O) in the hollow section before attaching the gearhead.

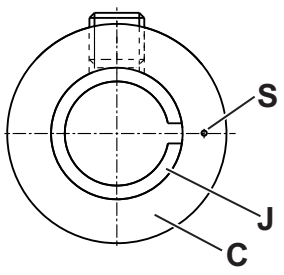
- Apply threadlocker (e.g., Loctite® 243) to the fastening screws.
- Fasten the gearhead to the machine with the fastening screws through the through-holes.

ⓘ Mount the gearhead in such a way that the identification plate remains legible, if possible.

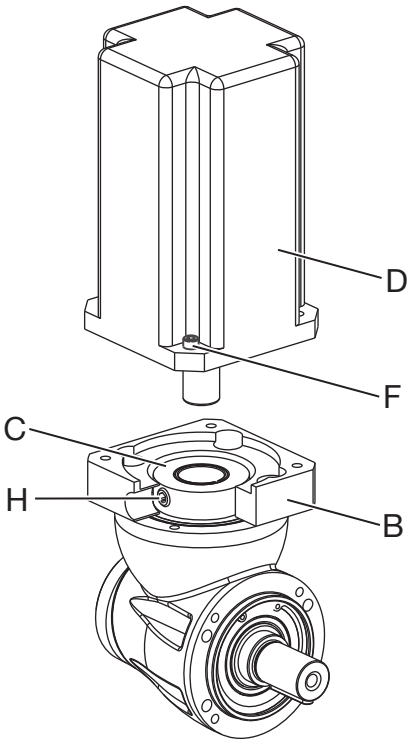
ⓘ Do not use washers (e.g. plain washers, tooth lock washers).

5.3 Mounting the motor on the gearhead

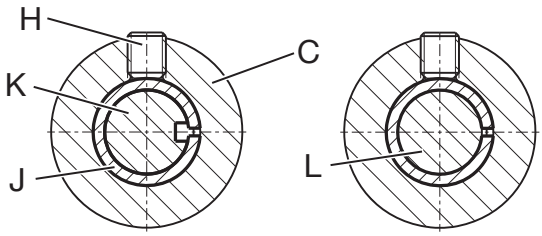
	● Observe the specifications and safety instructions of the motor manufacturer. ● Observe the safety and processing instructions for the threadlocker to be used.



- Insert the bushing (J) into the clamping hub (C). Align the bushing in such a way that the slot is pointing toward the centering bore (S).



- Ensure that the motor is mounted if possible in a vertical direction.
- If the motor shaft has a shaft key, remove the shaft key.
  - ⓘ If recommended by the motor manufacturer, apply a half key.
- Turn the clamping hub (C) so that the threaded pin (H) can be reached through the mounting bore.
- Push the motor shaft into the clamping hub of the gearhead (E).
  - ⓘ The motor shaft should slip in easily. If this is not the case, the threaded pin needs to be loosened more.
  - ⓘ The slot of the bushing has to line up with the groove (if present) of the motor shaft and be rotated by 90° against the threaded pin; see table "Tbl-7".
  - ⓘ No gap is permitted between motor (D) and the adapter plate (B).

		Designation
	C	Clamping hub
	H	Threaded pin
	J	Bushing
	K	Keyed shaft
	L	Smooth shaft

Tbl-7: Arrangement of motor shaft, clamping hub, and bushing

- Smear threadlocker (e.g. Loctite®243) onto the four screws (F).
- Fasten the motor (D) onto the adapter plate (B) with the four screws (F). Evenly tighten the screws crosswise with increasing torque.

- Tighten the threaded pin (H) of the clamping hub (C).

ⓘ For screw sizes and prescribed tightening torques, see Chapter 9.1 "Specifications for mounting onto a motor", Table "Tbl-14".

- Press the enclosed stopper plugs up to their stop into the mounting bores of the adapter plate (B).

5.4 Components mounted on the output side

NOTICE

Clamping forces during assembly can damage the gearhead.

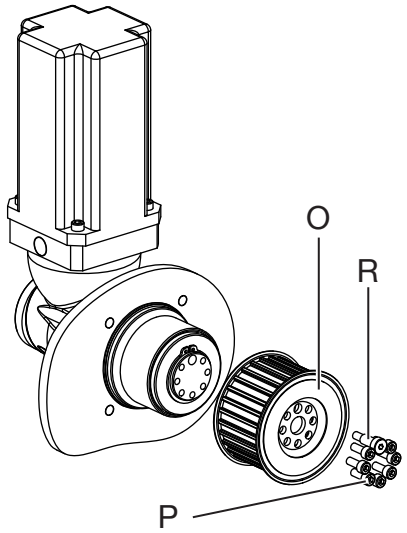
- Mount the mounting parts onto the output shaft without using force.
- Never attempt to assemble by force or hammering!
- Only use suitable tools and devices for assembly.
- Make sure not to exceed the maximum permissible static axial forces on the output bearing (see Table "Tbl-8") when pulling or shrink-fitting a mounting part onto the output shaft.

Gearhead size LK+	**050**	**070**	**090**	**120**	**155**
F_{2AMAX} [N]	100	200	450	750	1000
Gearhead size LPK+	**050**	**070**	**090**	**120**	**155**
F_{2AMAX} [N]	700	1550	1900	4000	6000
Gearhead size LPBK+	**—**	**070**	**090**	**120**	**—**
F_{2AMAX} [N]	—	1550	1900	4000	—

Tbl-8: Maximum permissible static axial forces at static load rating (s0) = 1.8 and radial force (FR) = 0

5.4.1 Mountings on the output flange (LPBK+ only)

	● Observe the safety and processing instructions of the cleaning agents and threadlocker to be used.



Only the LPBK+ version features an output flange on which a toothed belt pulley (O) can be mounted with bolts.

- Thoroughly clean the output flange, centering, fitting surface, spacer and toothed belt pulley. The anti-corrosion agent on the toothed belt pulley must be removed.

  ⓘ To remove the anti-corrosion agent, use acetone or Loctite® 7063, and a clean, lint-free cloth.
- Also clean the browned toothed belt pulley with a brush and remove any salt residue between the flanged wheel and toothed belt wheel.
- Place the toothed belt pulley onto the output flange.
- Apply threadlocker (e.g., Loctite® 243) to the screws, and tighten the screws by hand initially.
- Tighten the fastening screws (P) and the close-tolerance bolt (R) (1 piece) in diagonal order, making at least two passes to the prescribed tightening torque (see table "Tbl-9").

Gearhead size LPBK+	Close-tolerance bolt		Fastening screw	
	Thread x Depth [mm] x [mm]	Tightening torque [Nm] Property class 10.9	Quantity x Thread x Depth [ ] x [mm] x [mm]	Tightening torque [Nm] Property class 12.9
070	M5 x 12	7.69	5 x M5 x 12	9
090	M6 x 16	13.2	7 x M6 x 16	15.4
120	M6 x 16	13.2	7 x M8 x 20	37.3

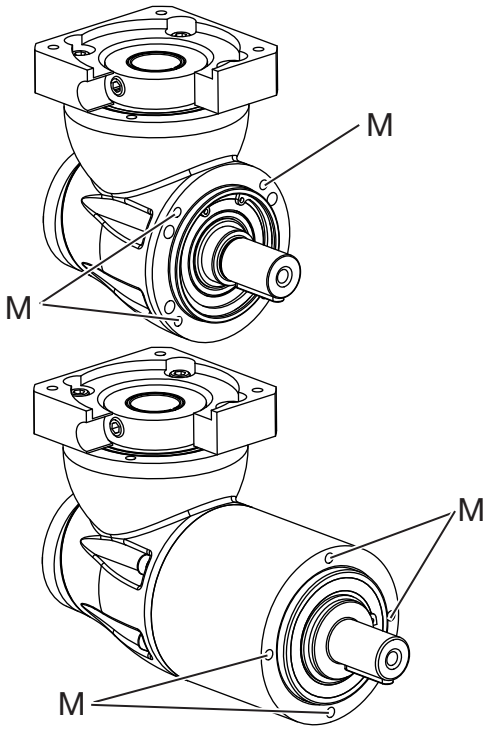
Tbl-9: Fastening the toothed belt pulley

The tension of the tooth belt is brought about by its construction. The toothed belt's prestressing force influences the ball bearing life of the gearhead.

- Use our **cymex®** specification software to determine the theoretical bearing life for each application scenario.
- Set the toothed belt so that there are no lateral starting loads pressing on the toothed belt pulley.

5.5 Mounting the gearhead to a machine (LK+/LPK+ only)

	● Observe the safety and processing instructions for the threadlocker to be used.



- Apply threadlocker (e.g., Loctite® 243) to the fastening screws.
- Fasten the gearhead to the machine with the fastening screws **only** through the threaded bores (M).
  - ⓘ Mount the gearhead in such a way that the identification plate remains legible.
  - ⓘ Do not use washers (e.g. plain washers, tooth lock washers).
  - ⓘ For appropriate screw sizes and tightening torques, see Chapter 9.2 "Specifications for mounting on a machine", Tables "Tbl-15" and "Tbl-16".

6 Startup and operation

- Read the general safety instructions before beginning work (see Chapter 2.7 "General safety instructions").

	Improper use can cause damage to the gearhead. ● Make sure that - the **ambient temperature** does not drop below –15 °C or exceed +40 °C and - the **operating temperature** does not exceed +90 °C. ● Avoid icing, which can damage the seals. ● For other conditions of use, consult our Customer Service department. ● Only use the gearhead only up to its maximum limit values, see Chapter 3.4 "Performance data". ● Only use the gearhead only in a clean, dust-free and dry environment.

7 Maintenance and disposal

- Read the general safety instructions before beginning work (see Chapter 2.7 "General safety instructions").

7.1 Maintenance work

7.1.1 Visual inspection

- Check the entire gearhead for exterior damage.
- The sealings are subject to wear. Therefore also check the gearhead for leakage during each visual inspection.

ⓘ Check the mounting position, so that no foreign medium (e.g. oil) has collected on the output shaft.

7.1.2 Checking the tightening torques

- Check the tightening torque of the threaded pin on the motor mounting.

ⓘ The prescribed tightening torques can be found in Chapter 9.1 "Specifications for mounting onto a motor", Table "Tbl-14".

- Check the tightening torque of the fastening screws on the gearhead housing. If, while checking the tightening torque, you discover that a fastening screw can be further tightened, follow the instructions in "Remounting the screw".

ⓘ The prescribed tightening torques can be found in Chapter 9.2 "Specifications for mounting on a machine", Tables "Tbl-15", "Tbl-16" and "Tbl-17".

- For LPBK+ gearheads, also check the fastening screws on the toothed belt pulley.

ⓘ The prescribed tightening torques can be found in Chapter 5.4 "Components mounted on the output side", Table "Tbl-9".

Remounting the screw

	● Make sure that it is possible to remount the screw on the gearhead without damaging the entire machine.

- Loosen the screw.
- Remove the glue residue from the threaded bore and the screw.
- De-grease the screw.
- Coat the screw with a threadlocker (e.g. Loctite® 243).
- Screw in the screw and tighten it with the prescribed tightening torque.

7.2 Startup after maintenance work

- Clean the outside of the gearhead.
- Attach all safety devices.
- Do a trial run before releasing the gearhead again for operation.

7.3 Maintenance schedule

Maintenance work	At startup	For the first time after 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection	X	X	X	
Checking the tightening torques	X	X		X

Tbl-10: Maintenance schedule

7.4 Notes on the lubricant used

All gearheads are lubricated for their service life by the manufacturer with a mineral oil-based lithium soap grease or with a food-safe synthetic grease (carbon hydride oil, aluminum complex soap) (see identification plate). All bearings are permanently lubricated by the company.

The manufacturer listed below will provide any further information on the lubricants:

Standard lubricants	Lubricants for the food industry (USDA-H1 registered)
Castrol Industrie GmbH, Mönchengladbach Tel.: + 49 2161 909-30 www.castrol.com	Klüber Lubrication München KG, München Tel.: + 49 89 7876–0 www.klueber.com

Tbl-11: Lubricant manufacturers

7.5 Disposal

Consult our Customer Service department for supplementary information on exchanging the adapter plate, on disassembly, and on disposal of the gearhead.

- Dispose of the gearhead at the recycling sites intended for this purpose.

ⓘ Observe the locally valid regulations for disposals.

8 Malfunctions

NOTICE

Changed operational behavior can be an indication of existing damage to the gearhead or cause damage to the gearhead.

- Do not put the gearhead back into operation until the cause of the malfunction has been rectified.

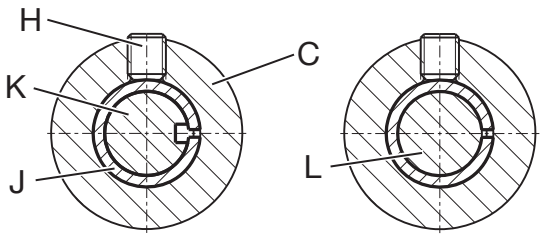
Rectifying of malfunctions may only be done by specially trained technicians.

Fault	Possible cause	Solution
Increased operating temperature	The gearhead is not suited for the task.	Check the technical specifications.
	Motor is heating the gearhead.	Check the wiring of the motor.
		Ensure adequate cooling.
		Change the motor.
	Ambient temperature too high.	Ensure adequate cooling.
Increased noises during operation	Distortion in motor mounting	Please consult our Customer Service Department.
	Damaged bearings	
	Damaged gear teeth	
Loss of lubricant	Lubricant quantity too high	Wipe off discharged lubricant and continue to watch the gearhead. Lubricant discharge must stop after a short time.
	Seals not tight	Please consult our Customer Service Department.

Tbl-12: Malfunctions

9 Appendix

9.1 Specifications for mounting onto a motor

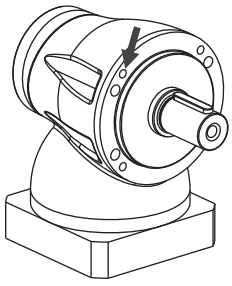
		Designation
	C	Clamping hub
	H	Threaded pin
	J	Bushing
	K	Keyed motor shaft
	L	Smooth motor shaft

Tbl-13: Arrangement of motor shaft, clamping hub, and bushing

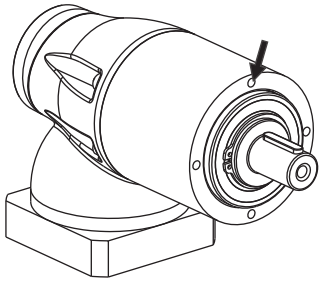
Gearhead size		Clamping hub internal Ø [mm]	Width across flats, threaded pin (H) [mm]	Tightening torque [Nm]	Max. axial force [N]
LK+/LPK+	**050**	11	3	5.6	45
LK+/LPK+/ LPBK+	**070**	16	4	14	80
	090	24	5	23	100
	120	32	6	45	150
LK+/LPK+	**155, 1-/2-stage**	42	8	78	180
	155, 3-stage	32	6	45	150

Tbl-14: Specifications for mounting onto a motor

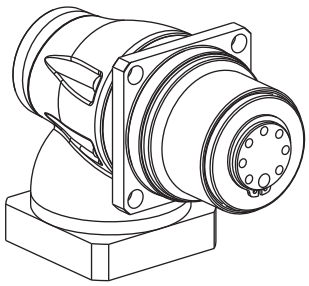
9.2 Specifications for mounting on a machine

	Gearhead size LK+	Hole circle Ø [mm]	Screw size / property class	Tightening torque [Nm]
	**050**	44	M4 / 8.8	2.64
	070	62	M5 / 8.8	5.24
	090	80	M6 / 8.8	8.99
	120	108	M8 / 8.8	21.7
	155	140	M10 / 8.8	42.7

Tbl-15: Threaded bores in gearhead housing LK+

	Gearhead size LPK+	Hole circle Ø [mm]	Screw size / property class	Tightening torque [Nm]
	**050**	44	M4 / 12.9	4.55
	070	62	M5 / 12.9	9
	090	80	M6 / 12.9	15.4
	120	108	M8 / 12.9	37.3
	155	140	M10 / 12.9	73.4

Tbl-16: Threaded bores in gearhead housing LPK+

	Gearhead size LPBK+	Hole circle Ø [mm]	For screw size / property class	Tightening torque [Nm]
	**070**	82	M8 / 12.9	37.3
	090	106	M10 / 12.9	73.4
	120	144	M12 / 12.9	126

Tbl-17: Through-holes in gearhead housing LPBK+

9.3 Tightening torques for common thread sizes in general mechanical engineering

The specified tightening torques for headless screws and nuts are calculated values and are based on the following conditions:

- Calculation in accordance with VDI 2230 (February 2003 version)
- Friction value for thread and contact surfaces μ=0.10
- Exploitation of the yield stress 90%
- Torque tools type II classes A and D in accordance with ISO 6789

The settings are values rounded to usual commercial scale gradations or setting possibilities.

- Set these values **precisely** on the scale.

	Tightening torque [Nm] with thread												
Property class Screw / nut	**M3**	**M4**	**M5**	**M6**	**M8**	**M10**	**M12**	**M14**	**M16**	**M18**	**M20**	**M22**	**M24**
8.8 / 8	1.15	2.64	5.2	9.0	21.5	42.5	73.5	118	180	258	362	495	625
10.9 / 10	1.68	3.88	7.6	13.2	32.0	62.5	108	173	264	368	520	700	890
12.9 / 12	1.97	4.55	9.0	15.4	37.5	73.5	126	202	310	430	605	820	1040

Tbl-18: Tightening torques for headless screws and nuts

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